

## Tips for Tips

### Initial mounting

The following is the process I utilize for the initial mounting of the fiberglass tips so they can be removed on RV's. Although, I've only worked on 7's, the process would be consistent with the other flavors of RV's. After working on several 7's, I've found this process to be the fastest and most efficient while providing very accurate alignment with the ailerons. Since most RV builders hate to deal with the fiberglass parts, I'm hoping this process will take out some of the stress in your build.

I might point out that Cleveland sells a tip mounting kit for RV's. Although I have purchased many tools from Cleveland, I do not like the tip mounting kit. It utilizes 4-40 screws and -04 nut plates. I feel these are too small for tips. Also there are no -04 screws anywhere in the stock RV kit. On my first 7, I used the kit and after stripping a couple of the screw heads, I replaced all the nut plates with -06 K1000's. Using -06 nut plates and screws makes it common with other hardware in the kit and readily available.

You are going to need 78 6-32" nut plates (K1000-06) and 78 509-06 screws. I ordered 100 each from Spruce. You get a little break when you order 100. You'll need extras anyway. You can use 8-32 but these are a little big for the purpose.

My standard disclaimer is: This is not the only way to do the job, but what works for me. Feel free to change and modify as you feel fit to meet your needs. There are many talented and experienced builders out there. I'm hoping they will pitch in with tips that will make fiberglass work easier for the builder.

I will be the first to say the fiberglass parts provided by Van's could be of higher quality. This is especially true of the parts with the white gel coating. On my current project, the tips appeared to be removed from the molds early, or "green," as it is called. The result is the edges that go under the skin are curled up. Also, I have found voids under the gel coating, or worm holes.

I'm sure it is cost related, but I wish the wing tips and empennage glass parts were epoxy glass and not polyester resin. This would be much easier to work with and only require one training process for finishing. On that note, I'm very confident that most RV builders would gladly pay a reasonable amount more for higher quality glass products.

In order to begin the process the ailerons must be mounted. And preferably the flaps too. The ailerons need to be centered with the bell crank jig in place. Using 2 pieces of thin aluminum sheet with approximate dimensions of 6" by 4" bend them into a trailing edge shape. (See photos) You'll also need a few spring clamps like those in the photos. You won't need these for a while.

Another thought. I've done this process with the wings flat on tables and with the wings in the cradles. The cradle method is much easier and will save you considerable time in the long run.

The first step is to make a foam rib that will be used to provide shape while you are fitting the tip to the wing. A piece of white bead foam 1" thick will work great. With someone helping, hold the foam against the end of the wing. Using a small length of 2x4 (6" works) tap on the outside of the foam to get an impression of the tip rib into the foam. The foam rib only has to be to the trailing edge of the wing skins and not all the way to trailing edge of the tip.

Remove the foam and mark the indent with a Sharpie if needed. Cut to the inside edge of the indent. Block sand the edge and test fit into the end of the wing, (not the wing tip). There needs to be approximately 1/16" clearance all the the way around (the thickness of the tip glass). Sand as needed. This is not super critical, but get close. If it is too big, it will be tough to fit the tip. Test fit the rib to the tip. Remove and set aside until later.

Measure the distance from the tip rib on the wing to the skins edge. From the joggle on the wing tip, make several tick marks, all the way around, with a fine tipped Sharpie. (Measure from the joggle toward the edge of the glass). Tape this line on the tip side so only that to be cut away is exposed.

In some areas sanding will remove enough to get to the tape line. As necessary, cut the material with a Dremel and textured cut off disc. Block sand to get to the tape line. Check your measurements. You don't want the edge to bottom out against the tip rib. When we get to fitting the tip, this will be checked and adjusted accordingly. When done, sand the edge of the cut to take the sharpness off. You'll be handling the tips a lot and you don't need injuries from the sharp edges.

You still can't fit the tip yet. We need to make another cut for the tip to clear the aileron hinge bracket on the bottom. Although you can't fit the tip yet, you can hold the bottom of the tip partially in place. Mark where the aileron hinge bracket intersects the edge of the tip.

Mark the tip the length of the chord of the hinge bracket. Now, measure the thickness of the bracket plus 1/16." Transfer this measurement to the tip and mask off. Cut, file and true up the cut. The photo shows this cut.

You will now be able to get a preliminary fit on the tip. Slip the tip into place and look for signs of interference. Look for the tip hitting the tip rib before the skin settles against the joggle. If so, block sand the tip to get the clearance. Look for adequate clearance of the tip clearing the aileron bracket. I like 1/16" clearance here. File to get the gap you desire. Remember to allow for primer/paint clearance.

Once you can fit the tip in place without interference, check the gap between the aileron and tip. It is not important to set this gap now, only that it clears without interference. We'll cut this gap to width later.

Now, lock your aileron in place with the jig installed at the aileron bell crank. With one of the pieces we made from the thin sheet aluminum earlier, clamp the aileron and flap together. Put the tip in place and clamp the tip to the aileron. This helps hold the tip in place. Check everything for alignment. The trailing edge of the tip is not going to match the trailing edge of the aileron. Don't worry, you can still clamp things in place. The TE will be cut to match later.

The next step is optional but I highly recommend it, adding thin aluminum reinforcement strips where the nutplates will get riveted to the tip. With the tip still in place, use a Sharpie to mark the holes on the tip. **DO NOT DRILL YET.** This is just to give a guide for the this step.

To speed the process, I use 5 minute epoxy to bond the strips to the tip. In your kit there is a bundle of aluminum strips approximately 1/2" wide for this purpose. Look at the location of the marks you made for holes. Make some tick marks on the inside of the tip for the approximate hole location. Instead of using a couple of long strips, I like to divide the holes in order to use strips for 3-4 holes. Make sure you extend the strip at least 1" from the hole location. Cut as desired, clean and scuff the side to be epoxied to the tip. Next, clean the inside of the tip where the strips will go with acetone wipe clean. Use your Dremel and sanding drum to scuff the area. Wipe again with acetone. Remark the approximate hole locations. Test fit the strips and mark the end locations.

Mix a small quantity of 5 minute epoxy. (two small M&M sized blobs will work). Spread a thin layer of epoxy on the glass and lay the strip in place. Clamp in place. Wipe away any excess epoxy. As you do the task, you'll get a feel how much epoxy to use to avoid a mess and waste. If you are quick, and have enough clamps, you might be able to get 2-3 strips applied per mix of epoxy. Continue with all strips until completed.

Please note, if you are using any Archer Antennas use one strip that will span the width of the antenna that will be attached with the nutplates. The photo shows this location.

Block sand any excess epoxy from the edge of the tip before proceeding. Clean up any other areas to your liking.

You are now ready to begin fitting and drilling the tips. Use a new #40 drill bit. Fiberglass tears these things up so don't hesitate to use a new one when you feel the need. Drill bits are cheap in the scheme of things.

If you have help the job might be a little easier. You can certainly do it on your own though. Here we go. Put the foam rib in place in the tip. Do a test fit to the wing. If you got the tip on okay, then the rib is fine. You can use a hot glue gun to put a few dabs of

glue to hold the rib in place. If the tip is hanging up, you may need to sand the foam down a little in the area that is the problem.

Put tip in place and clamp the alignment pieces to the tip and aileron. Check to see that the tip has seated into the leading edge of the wing as far as possible. Adjust as necessary. With a credit card, establish a space between the lip of the joggle and the skin. This will give you a good gap for painting.

Hold the credit card in place and drill your first hole using the hole closest to the trailing edge, cleco. Doesn't matter if you start on the top or bottom. Go to the other side and drill the same location, the hole closest to the trailing edge. Don't press too hard on the drill. Let it work so it doesn't pull the tip out of alignment when it finally goes through. Have your helper insure the tip isn't shifting around the leading edge.

Drop down a few holes and repeat the process maintaining the gap. Don't worry if the gap is somewhat inconsistent. The recessed edge in the tip is not the best. We will clean it up later. Drill all holes. You are now match drilled.

With the tip still in place, measure and mark your desired gap between the aileron and tip. I use 3/16." To obtain symmetry, use the same gap that you have between the aileron and flap. Remove and cut the tip. Block sand. Reinstall the tip with a few clecos. Check your aileron to tip gap. Adjust as necessary.

Next is project is fitting the metal tip ribs, part number xxxx. The plans call for you to use the flush side of the rib close to the tip edge and pop rivet in place. I prefer to do it differently as I learned from someone else. This method allows you to squeeze the rivets and makes it very easy to fill the channel with foam and glass over if you desire. If you don't want to fill in the gap, that is fine and it looks great as is.

On the sticker it will tell you left or right. Using a Sharpie, remark them opposite of what the sticker indicated. We are flipping them over so they will be in the opposite tip. Slip the rib in place and test fit. Don't force it back too far or you'll bulge the skin. The rib should be about 3/4" inset from the tip edge.

Once you have it in place, mark the location and measure the distance from the edge of the tip to the edge of the rib flange. Now, pull the rib and mark a center line on the flanges, top and bottom. On the outer skin of the tip, make a line equal to the center line on the flanges. Mark the hole distances on the line. Inch and a half spacing is adequate. Drill a hole in the glass at the two end locations on one side. Place the rib back in place and insure it is in the proper location, fore and aft. Adjust until you can see your Sharpie line in the two holes. Drill and cleco. Repeat on the other side, doing a couple at a time.

You may have to adjust the flange of the rib if it is hitting your back up strips for the nut plates. A Dremel and file will take care of that.

With the rib clecoed in place, refit the tip to the wing. Make sure everything fits well. If for some reason you pushed the rib too far toward the trailing edge and created a bulge making the fitting tough, you'll have to reposition. That is the beauty of fiberglass, repairs are easy.

Time to make some tools to make the riveting and nut plate job much easier. Fiberglass is really tough on metal tools. I highly recommend that you do not utilize your countersink bits or deburring tool on the fiberglass parts. We are going to make two very simple tools for your Dremel that will make the job very easy.

We are going to modify two Dremel grinding stone bits. The small one will be modified to a point and serve as a countersink tool for the rivets. The larger one will be modified as a countersink for the tip flange to accept the dimples in the wing skin.

Look at the photos to see the grinding bits we are going to modify. You can get these at Lowe's, Home Depot, hobby shops, or anywhere that sells Dremel stuff. You can see the before and after photos. You'll have under \$5 in these two great, long lasting tools.

This is a completely non scientific process. I'm sure someone will have a method to get it exact but it is extra work that isn't really necessary. I started by using a scrap piece of aluminum 1/4" thick as a jig. A #40 hole was drilled and then countersunk with the countersink tool to simulate a counter sink for a rivet. (Whew, that was a mouthful). Now chuck the small stone in the Dremel. Turn on the Dremel to a relatively high speed and turn on your bench grinder. Grind a point on the stone that is close to the taper on a rivet head. Test with the jig countersink you made. Work this till you're satisfied.

Repeat the process for the larger stone using the appropriate drill size and counter sink to accept a dimpled skin.

One of my least favorite things in the building process is setting nut plates. This process is quite easy and goes pretty quickly.

Everything has been match drilled and we are ready to set up the nut plates in the wing tip. Start by clecoing a nut plate on the outside of the flange. Place it upside down and cleco from inside the tip. Align it and drill a hole through the mounting lug hole through the glass and the reinforcement strip. Cleco and drill the second hole. One down, 77 to go.

Some might be saying, "why not just match drill to the 6-32 size from the start?" You can but by keeping at a #40 hole the silver cleco will hold everything centered precisely. If you drill to 6-32 you'll have to use a 6-32 screw to hold the nut plate centered. More work and time. I've tried this, used the nut plate jig, and I come back to this method.

After all nut plates are drilled, deburr the reinforcement strip. Reinstall the wing tips and cleco every hole. Drill each hole to #30 and cleco. The 30 is close to the final hole size. Remove the tips and deburr again.

You are now ready to use the counter sinking tools we made. You only have 156 holes to countersink!!!! Using your Dremel and the small bit we made, begin to counter sink the holes where the rivets will go. Start slowly. Use a long length -3 rivet as your guide as it is easier to handle. Do each hole until the rivet sits flush with the skin. View from the top to insure you are getting a true hole. Adjust as needed. You'll have the hang of it in no time. I've found that using a high speed on the Dremel makes the job easier.

Time to countersink the large hole for the dimpled wing skin. I made a guide with the appropriate sized dimple in a scrap piece of metal strip. Use the same process as before and insure the dimple sits flush in the hole. When complete drill the center hole to #27. Dimple the wing skins with the appropriate dimple.

Before I final install any nut plate, I "season" them to make them easier to use. I have also found defective nut plates. It is a bad thing to find that out after they have been installed. I made a fixture to hold the nut plate so a screw can be run through it once before installation. See the picture. A similar jig will be available through JDair very soon. This is a "must have" item to make nut plates easier to use and insure you do not have defective ones.

One last task before we call it "done." You will notice that when you put a screw in a dimpled hole, it doesn't seat well. I learned a technique that makes the screws seat nicely. Use your deburring tool in a cordless drill and run it in the dimpled hole. This will square up the edges and make the screw fit very nicely. Very little metal is removed so don't worry about that.

I sincerely hope this two part "how to" has been helpful to you. Part 3 of the Tip series will cover prepping the tips for paint. We'll also cut the trailing edge of the tip to match the aileron. I know that many do not enjoy the fiberglass work and if this has made it less painful and resulted in good work, then I have been successful. The RV is a great airplane and so much fun to fly. Getting you in the air sooner will make the hurt of the unpleasant tasks go away quickly when you are cruising at 170 kts!!!!